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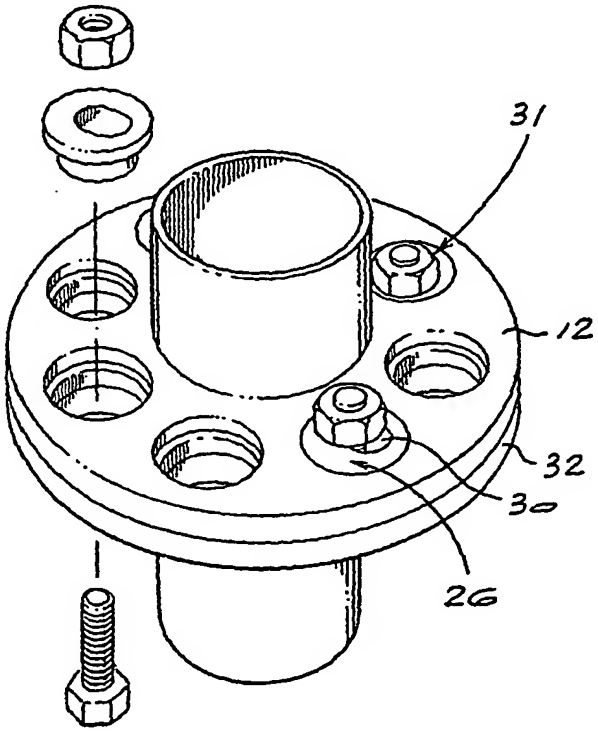
(54) Title: VARIABLE FLANGE



(57) Abstract: The invention concerns a variable flange which can be used to connect together pipes, shafts or the like. The flange (10) includes an annular flange member (12) that is mountable on the pipe (14), shaft or the like. Primary openings (22) are formed transversely in the flange member (12). The flange also includes flange inserts (26) each of which has an eccentrically positioned secondary opening (30) therein to receive a connecting bolt (31). The inserts are seatable and rotatable in the primary openings (22) to vary the pitch circle diameter of the flange as defined by the secondary openings (30). This enables the flange (10) to mate with a range of standard flanges complying with one or other flange standard.

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VARIABLE FLANGE

BACKGROUND TO THE INVENTION

THIS invention relates to a variable flange for the connection of pipes, shafts and the like to one another.

Flanges are widely used for the connection of pipes and shafts, the flanges providing the area through which connecting bolts may be passed. Pipe flanges are commonly used to connect pipes which are not intended to be joined by welding, or where the pipes do not have threaded connections.

There are various international flange standards that have been developed over the years, and in accordance with these standards tables have been compiled that specify flange sizes based on the nominal or outer diameter of the pipes. Generally, only flanges based on the same tables may be connected to one another, as the international standards are not normally compatible with one another. For example, the number of bolts, the pitch circle diameter of the bolt holes and the size of the connecting bolts specified may not correspond from one standard to another.

The present invention seeks to provide a variable flange that may be connected to a range of standard flanges.

SUMMARY OF THE INVENTION

According to the present invention there is provided a variable flange for the connection of pipes, shafts or the like, the flange comprising an annular flange member that is mountable on a pipe, shaft or the like, a plurality of primary openings formed transversely in the flange member and a plurality of flange inserts each having an eccentrically positioned secondary opening therein to receive a connecting bolt, the inserts being seatable and rotatable in the primary openings to vary the pitch circle diameter of the flange as defined by the secondary openings.

In some embodiments, the secondary opening of each insert is a round bore the central axis of which is spaced from the central axis of the insert. The secondary opening may be internally threaded to receive a connecting bolt in threaded engagement.

In other embodiments, the secondary opening of each insert is elongate, typically elliptical in shape.

In the preferred embodiments, the primary openings include a shoulder on which the insert seats complementally. The shoulder may, for instance, be conically tapered, each insert including a conically tapered surface seatable complementally on the shoulder.

In another possibility the shoulder is stepped and each insert includes a stepped formation seatable complementally thereon.

In yet another possibility, the shoulder is spherically curved shoulder and each insert includes a complemental, spherically curved surface seatable thereon.

The flange member may either be adapted for permanent connection, for example by welding, to the pipe, shaft or the like, or it may be a loose component adapted to seat on a collar on the pipe, flange or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a partial, sectioned side view of a variable flange according to this invention, with a connecting bolt shown *in situ*;

Figure 2 shows an axial view of a flange connection and illustrates a portion of both a standard flange and the variable flange of Figure 1;

Figures 3 to 5 show partial, sectioned side views of flanges according to further embodiments of the invention;

Figure 6 shows a partially sectioned side view of a further embodiment which includes a loose flange member;

Figures 7a and 7b respectively show a sectional side view and a face view of a flange insert according to another embodiment of the invention;

Figure 8 shows a perspective view of a flange connection formed using flange inserts of the type illustrated in Figures 7a and 7b; and

Figure 9 shows a sectional side view of a flange insert according to yet another embodiment of the invention.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

The variable flange 10 shown in Figure 1 has an annular flange member 12 which is welded to a pipe 14 by two fillet welds 16 and 18. The flange member has a facing 20 which is intended to abut against the facing of another flange, generally with a gasket (not shown) being placed between the flanges. A number of primary openings in the form of bores 22 pass transversely through the flange member 12 and a conically tapered shoulder 24 is formed in each of the primary bores as illustrated.

A flange insert 26 is seated in each of two or more of the primary bores 22. The flange insert has a conically tapering, mating surface 28 shaped to seat complementally on the shoulder 24. A secondary opening in the form of a bore 30 passes transversely through the flange insert 26 and is positioned eccentrically relative to the central axis of the insert.

Figure 2 shows an axial view of a pipe flange connection for a pipe of nominal radius NR. The upper part of Figure 2 shows a portion of a standard flange 32 and the lower part shows a portion of the variable flange 10 according to the invention. The standard flange has a facing 36 with a flange radius SFR, a flange bolt radius SBR (corresponding to half of the pitch circle diameter or PCD) and a flange bolt hole 38 of diameter SBD, all sized according to the international standard table to which the flange complies.

The variable flange 10 has a flange radius UFR, a nominal insert radius UIR and an insert diameter UID, corresponding to the diameter of the primary bore 22. The flange insert 26 is seated in the primary bore against the shoulder 24.

The flange 10 is connected to the standard flange 32 in the following manner. Each flange insert 26 is selected for its secondary bore diameter SBD to correspond with the standard flange bolt diameter SBD. The

inserts are rotated within their primary bores 22 until the secondary bores aligns with the bolt holes 38 of the standard flange. The pitch circle diameter (PCD) of the secondary bores now corresponds with that of the standard flange. Connecting bolts 31 are passed through the aligned bolt holes 38 and secondary bores 30 and nuts are run up and tightened on the ends of the bolts to connect the standard and variable flanges together.

It will be appreciated that flange inserts 26 need not be placed in the primary bores 22 of the flange 10 if there is no corresponding bolt hole 38 on the standard flange 32.

The flange 10 may be manufactured from a variety of materials and in various flange sizes. The dimensions of the flange radius UFR, the insert radius UIR and the insert diameter UID are all sized by calculating the average dimensions of a range of standard flanges. In this way, for a specific pipe outer or nominal diameter, the flange 10 is vaiable to facilitate connection to a range of corresponding, standard flanges. In practice, selection of the correct flange insert 26 will be from a range of such inserts, with different SBD values, which are provided for each flange member 12. 38. In this way a person forming a flange connection will be able to assemble a flange that is connectable to a range of standard flanges without knowing in advance the standard to which the original standard flanges comply.

The flange inserts 26 may be rationalized to a limited number of sizes to allow the inserts to be connected to a meaningful range of universal flange sizes, typically the standard flange sizes which are most commonly encountered in practice.

For larger pipe sizes the flanges 10 may utilize inserts within inserts to allow for further variation of the bolt hole sizes and positioning of the bolt holes.

Figures 3 to 5 show alternative embodiments of the flange 10 and illustrate different shoulder arrangements 24 for seating the flange inserts 26. In Figures 3 and 4, the shoulder is stepped and the insert includes a complemental, stepped formation to seat on the shoulder. In Figure 5 the shoulder is spherically curved and the insert has a complemental spherical curvature. It will be appreciated that numerous other configurations of the shoulder and insert will also fall within the scope of the invention.

Figure 6 shows a loose flange type connection, corresponding to the embodiment illustrated in Figure 1. In this type of connection the flange member 12 is not welded to the pipe 14 and merely abuts against a collar 40 formed on the pipe.

It will be understood that as the insert in any of the embodiments described above is rotated the centre of the bore will move both radially and circumferentially. This dual movement may cause alignment problems. The potential alignment problem is addressed by an embodiment employing a modified flange insert 26 such as that illustrated in Figures 7a and 7b. This flange insert has a cross-sectional shape somewhat similar to that of the insert seen in Figure 3 but in this case the opening 30 is not in the form of a circular bore, but has an elongate, elliptical shape. The major axis 42 of the elliptical shape is radially orientated and one focus of the ellipse lies on the central axis 44 of the insert. It will be understood that the elongate shape of the opening 30 enables it to align with a wider range of standard flange bolt holes than may be possible with a circular opening.

Figure 8 shows a perspective view of a connection between a standard flange 32 and a flange 10 in which the modified inserts of Figures 7a and 7b are used. It will be noted that as the standard flange 32 has only four bolt holes, inserts 26 with bolts 31 are provided in only four of the eight primary bores 22 in the flange member 12.

Figure 9 shows a cross-sectional view of another flange insert 26. This insert has a circular secondary opening or bore 30 as in the earlier

embodiments, but differs from those inserts in that this opening or bore is internally threaded, as indicated by the numeral 46. The thread is selected for engagement with the standard bolts which will be used to make the flange connection. With this feature, the connecting bolt is passed through the standard flange bolt hole and is threaded into the bore 30 without the need for a nut. The eccentricity of the bore 30 prevents the insert 26 from rotating as the bolt is tightened up.

The description above has been directed towards the connection of pipe flanges but it will be appreciated that the principles of the invention are applicable to other flanged connections such as connections between shaft sections in both static and rotary applications. Also, although mention has been made of connections between standard flanges and variable flanges of the invention, it will be recognised that variable flanges of the invention may also be connected to one another. In such applications, where the embodiment of Figure 9 is used, internally threaded inserts will be used in only one of the flanges which are to be connected.

CLAIMS

1.
A variable flange for the connection of pipes, shafts or the like, the flange comprising an annular flange member that is mountable on a pipe, shaft or the like, a plurality of primary openings formed transversely in the flange member and a plurality of flange inserts each having an eccentrically positioned secondary opening therein to receive a connecting bolt, the inserts being seatable and rotatable in the primary openings to vary the pitch circle diameter of the flange as defined by the secondary openings.

2.
A variable flange according to claim 1 wherein the secondary opening of each insert is a round bore the central axis of which is spaced from the central axis of the insert.

3.
A variable flange according to either one of the preceding claims wherein the secondary opening is internally threaded to receive a connecting bolt in threaded engagement.

4.
A variable flange according to claim 1 wherein the secondary opening of each insert is elongate in shape.

5.
A variable flange according to claim 4 wherein the secondary opening of each insert is elliptical in shape.

6.
A variable flange according to claim 5 wherein the secondary opening has its major axis oriented radially relative to the central axis of the insert.

7.
A variable flange according to claim 6 wherein one focus of the secondary opening lies on the central axis of the insert.

8.
A variable flange according to any one of the preceding claims wherein each primary opening includes a conically tapered shoulder and each insert includes a conically tapered surface seatable complementally on the shoulder.

9.
A variable flange according to any one of claims 1 to 7 wherein each primary opening includes a stepped shoulder therein and each insert includes a stepped formation seatable complementally on the shoulder.

10.
A variable flange according to any one of claims 1 to 7 wherein each primary opening includes a spherically curved shoulder and each insert includes a spherically curved surface seatable complementally on the shoulder.

11.
A variable flange according to any one of the preceding claims wherein the flange member is a loose component adapted to seat on a collar on the pipe, flange or the like.

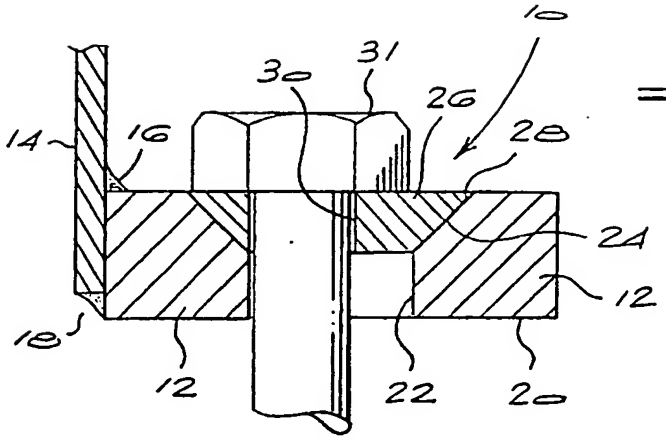


Fig 1

Fig 3

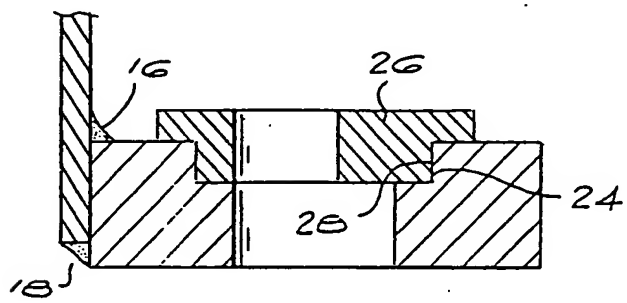


Fig 4

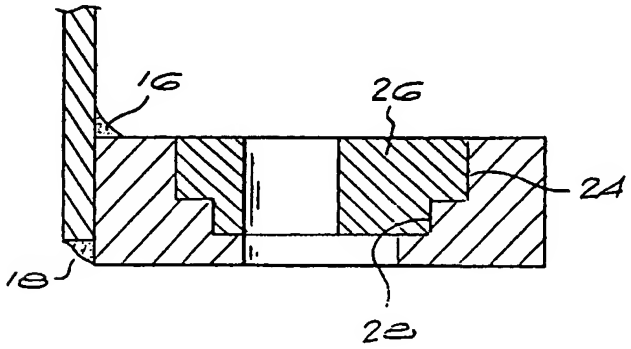
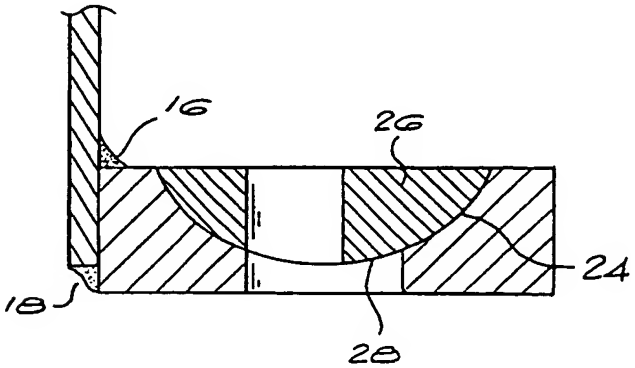


Fig 5



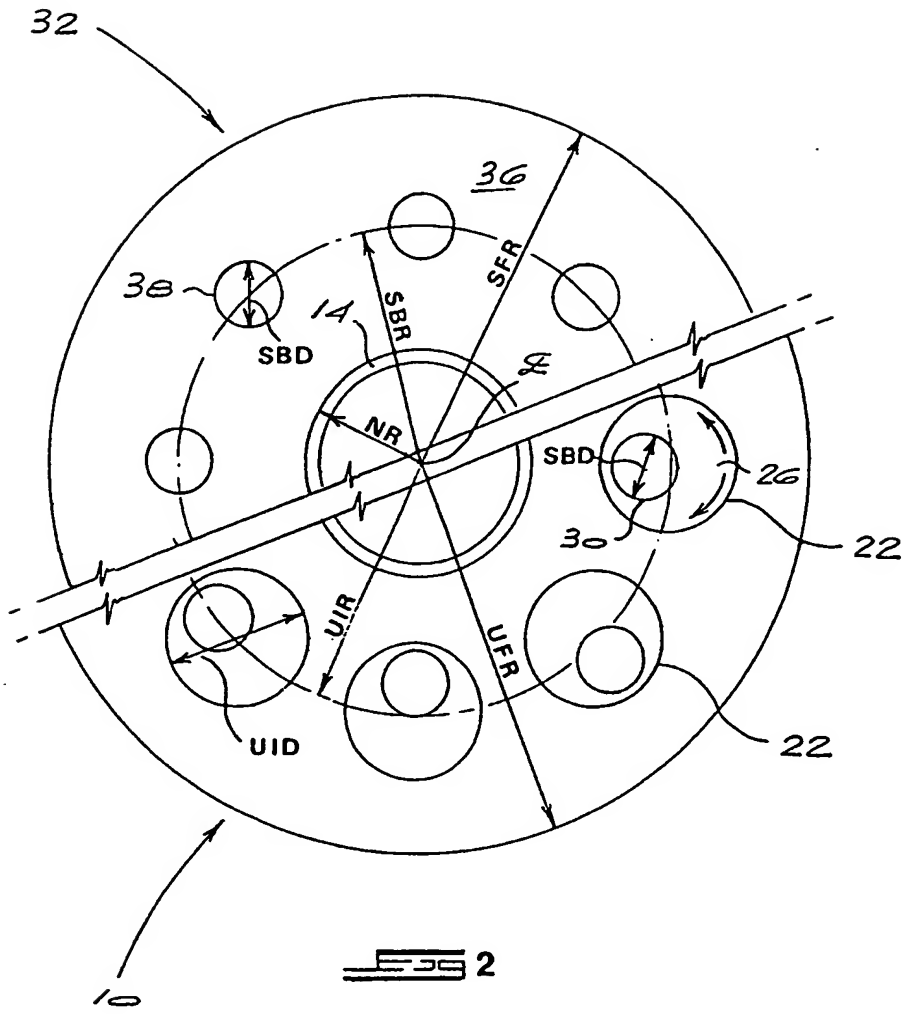


Fig 2

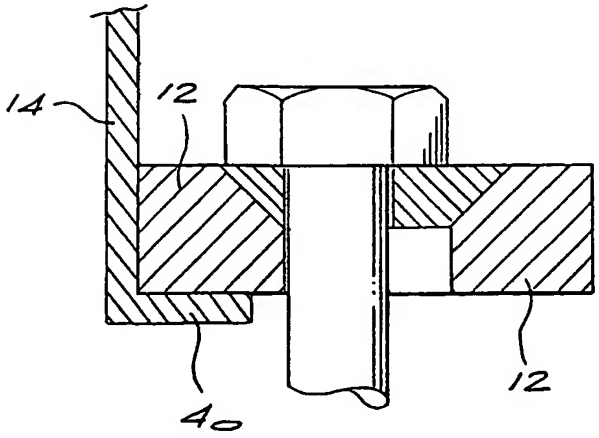
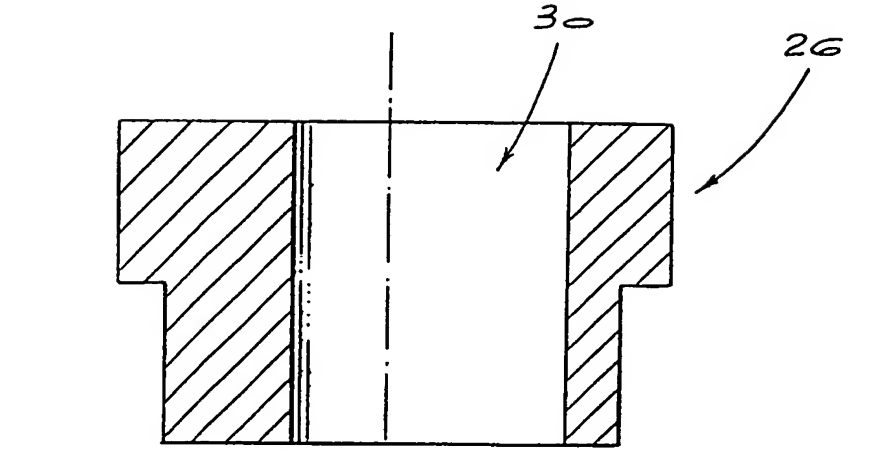


Fig 6

Fig 7a



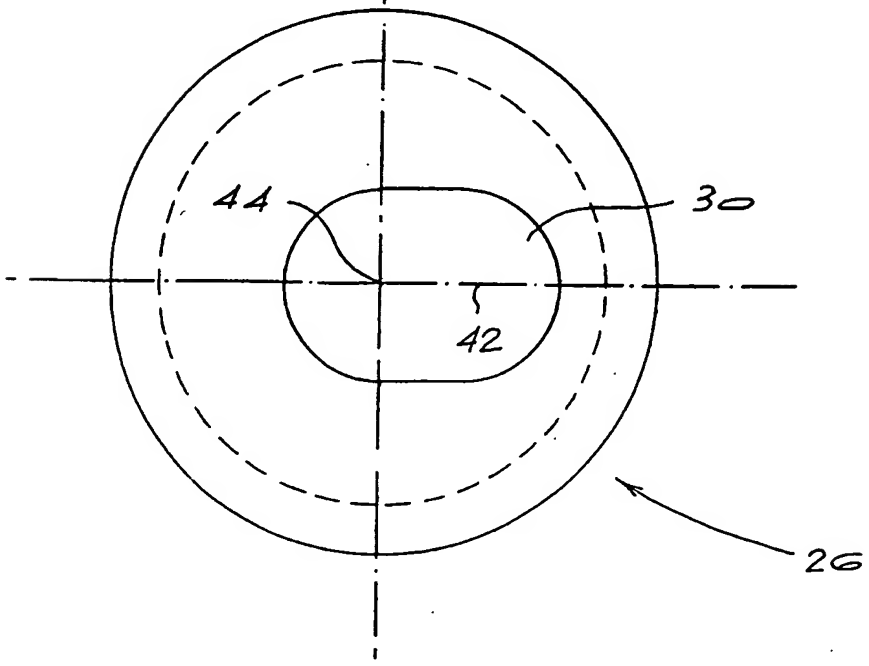


Fig 7b

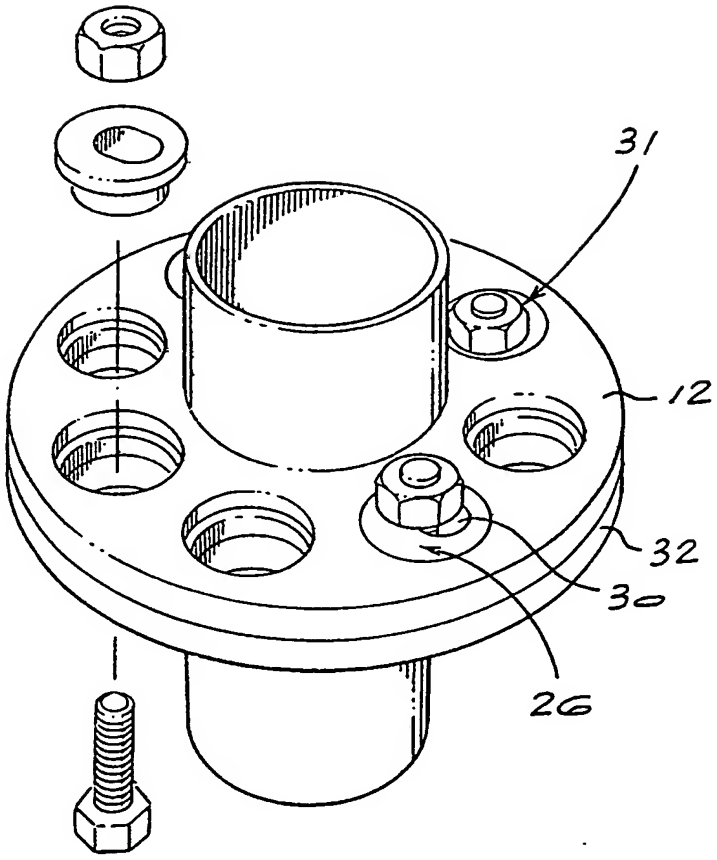


Fig 8

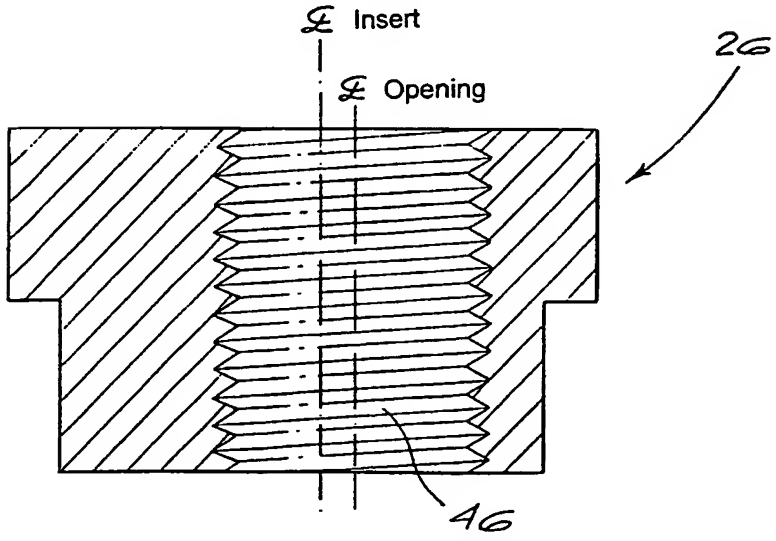


Fig 9

INTERNATIONAL SEARCH REPORT

Intern nal Application No
PCT/IB 00/01209

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16L23/036

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16L F16B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	US 3 077 960 A (LANG G) 19 February 1963 (1963-02-19) column 3, line 51 - line 55; figure 11	3
Y	EP 0 325 736 A (NETTER GMBH) 2 August 1989 (1989-08-02) column 2, line 45 - line 48; figure 1	4-7
Y	US 4 503 680 A (WOOD TERRY G) 12 March 1985 (1985-03-12) column 1, line 13 - line 27; figures 3,4	11

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
17 November 2000	28/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Axelsson, T

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INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/IB 00/01209

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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